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GREAT BRITAIN

PATENT SPECIFICATION

626,727

Application Date: Nov. 29, 1946. No. 35490/46.

Complete Specification Left: Nov. 28, 1947.

Complete Specification Accepted: July 20, 1949.

Index at acceptance:—Class 98(ii), D6.

PROVISIONAL SPECIFICATION

Improvements in or relating to the Recording of Sound Tracks in Colour Film

We, GEOFFREY BOND HARRISON, a British Subject, and ILFORD LIMITED, a British Company, both of 23, Roden Street, Ilford, in the County of Essex, do hereby declare the nature of this invention to be as follows:—

This invention relates to colour photography and particularly to methods of colour photography using a multilayer photographic kine film wherein the processing of the layers of such film to form colour images therein involves the selective exposure of the layers, and is particularly concerned with the recording of a sound track in such film.

One technique which has been proposed for the production of a kine colour film employs a multilayer film which includes in superposition, in order, light-sensitive silver halide emulsions sensitive to blue, green and red light respectively and, separating the emulsion layers from one another, yellow filter or "barrier" layers. The normal photographic emulsion is sensitive to blue light and the yellow filter layer which lies between the blue-sensitive layer and the green-sensitive layer serves to absorb blue light so that when the film is exposed in the camera the blue light of the subject does not record in the red- and green-sensitive layers.

In processing such a material it is usual to form colour images in colours which are subtractive with reference to the utilised sensitivities of the layers. Thus a yellow positive image is formed in the original blue-sensitive layer, a magenta positive image in the original green-sensitive layer and a blue-green or "cyan" image in the original red-sensitive layer. The production of such colour positive images where the support for the emulsion is colourless and transparent or translucent may be as follows: After exposure in the camera the multilayer film is developed in a normal developer yielding negative silver images in the three emulsion layers. The blue-sensitive layer is then re-exposed to blue light and the effect of the exposing light is confined to the blue-sensitive layer by the yellow barrier layer lying behind it. This blue-sensitive layer is then processed to a positive yellow image. The red-sensitive layer is then exposed to blue light passing through the support and again the action of the blue light is confined to the red-sensitive layer by the adjacent yellow barrier layer. The red-sensitive layer is then processed to form a positive cyan image. In order to effect exposure of the middle layer which lies between the barrier layers, it has been proposed to use exposing light which is of such wavelength as will penetrate the barrier layers. Thus, if the green-sensitivity of this layer has not been destroyed by the earlier treatments, it is practicable to effect exposure by means of green light. Alternatively, the middle layer may be rendered developable by exposure to intense blue light, or by exposure to X-rays, or by chemical treatment, for example with a 5% aqueous solution of sodium arsenite or hydrogen peroxide or guanidine thiocyanate, and then developed to form a positive magenta image therein.

It is possible to record a sound track on the film using white light, in which case the sound track will appear in the final film as a reversed track recorded in each of the three layers as dye images of the same colours as the picture images in the respective layers. This method, however, is not wholly satisfactory and it is preferred that the sound track should be confined to a single layer, two layers, or all three layers of the material in a dye selected with regard to the characteristics of the photo-cell to be used in

[Price 2/-]

the reproduction, said dye not necessarily being one of the dyes used for a picture image.

The present invention is concerned with the use of a multilayer film comprising a support carrying three silver halide emulsion layers selectively sensitive to red, green and blue light (the red- and green-sensitive layers being in either order but both on one side of the blue-sensitive layer) and containing barrier layers (separating the emulsion layers) which have a substantial density to blue light. Such barrier layers may be present in the material initially or may be formed in the material during its processing provided, however, that a blue-absorbing layer is present in the original multilayer film between the emulsion intended to record the blue aspects of the subject photographed and the other emulsion layers.

In the present invention the picture record is obtained in such multilayer film by developing the exposed film in a reversal photographic developer, selectively rendering the residual silver halide in the emulsion layers developable, and developing such layers by means of an aromatic primary amino developing agent in the presence of colour-formers which couple with the oxidation products of such developing agent, formed during the development, to form quinone-imine or azomethine dye images respectively subtractive in colour in relation to the utilised sensitivities of the respective emulsion layers.

In the preferred form of the invention the colour-formers are included in the developing solutions, but the invention includes the possibility of one or more of the colour-formers being present in the emulsion layers (or in layers adjacent thereto).

The order of the emulsions in the multilayer material is preferably blue-sensitive, green-sensitive and red-sensitive, and the invention will be described with particular reference to a multilayer material of this kind. If the order of the green- and red-sensitive layers is reversed, adjustments in the order of the processing steps become necessary.

In accordance with the present invention, in employing a multilayer film material as above defined and processing it to form colour picture images therein by the method above defined, a negative sound track is recorded in the material (by direct exposure or by printing) so that it is recorded in one, two or all three of the emulsion layers, the sound track area only of the film is thereafter re-exposed to form a reversed image in one, two or all three emulsion layers, and the reversed images thus obtained are colour-developed to form positive sound track images in dyestuff, the dyestuff sound track images thus formed, or at least one of them, being in a dyestuff different from the dyestuff used for the picture area of the layer in which the said track is located.

Where any of the emulsion layers initially contains a colour-former the colour development will usually produce some image in the sound track in the dyestuff which is derived from the colour-former present in such layer, which will be the same dyestuff as is present in the associated picture area of that layer: in accordance with this invention, however, the colour development in such a case may be effected in the presence of a different colour-former present in the developing solution so that the resulting track is formed of two dyestuffs, one of which is different from that used in the picture area.

The first sound track may be recorded or printed in any one, any two or all three layers by suitable choice of recording or exposing light. The final positive sound track may be confined to any one, any two or all three of the layers by suitable choice of re-exposing light and within the limitation that the final record cannot exist in a layer in which the original sound track was not recorded. According to the stage of the processing at which the re-exposure or re-exposures of the sound track regions take place, the sound track or sound tracks may be produced by a single colour or a superposition of two or more colours. It is the feature of this invention that at least one of these colours is different from the colour in which the sound track image in that layer would have been reproduced had that sound track image been re-exposed and developed to colour simultaneously with the picture image in the same layer.

The following are examples of the various procedures which may be employed within the scope of the present invention. In these examples the multilayer material consists of:

(a) transparent or translucent colourless support.
(b) silver halide emulsion layer sensitive to red light.
(c) a layer absorbing blue light and either present in the initial material or formed therein during or immediately subsequent to the first development of the material.
(d) silver halide emulsion layer sensitive to green light.
(e) a layer similar to (c) which, if the

blue-absorbing characteristic is formed during or immediately subsequent to the first development, also contains a blue-absorbing material which can be removed or destroyed at any convenient stage in the processing.

(f) silver halide emulsion layer sensitive to blue light.

For preference layers (c) and (e) are of the type described in Application No. 17544/45.

The assembly may contain other layers, e.g. an anti-halation layer and a non-stress supercoat layer if desired.

PROCEDURE I.

1. Expose to a coloured subject.
2. Expose sound area to record a negative sound track, the exposure being by blue light, thus confining the image to layer (f).
3. Develop in a non-colour-forming developer.
4. Re-expose the picture area only of (f) with blue light.
5. Colour-develop layer (f) in a yellow colour developer.
6. Re-expose picture area only of bottom layer (b) with blue light passing through (a).
7. Re-expose the sound track area only of (f) with blue light.
8. Colour-develop (b) and sound track of (f) in a cyan colour developer.
9. Re-expose picture area only of middle layer (d) from both sides with blue light of sufficient intensity to penetrate layers (c) and (e).
10. Colour-develop (d) with a magenta colour developer.
11. Remove silver and residual silver salts by treatment with Farmer's reducer.

This procedure results in a product in which there is a true colour record of the original subject in the picture area and a positive (i.e. reversed) sound track image in cyan dye in the original blue-sensitive layer.

PROCEDURE II.

The procedure I is followed except that the group of steps 6, 7 and 8 are carried out before the group of steps 4 and 5. A similar product is obtained.

PROCEDURE III.

The procedure I is followed except that the original exposure step 2 is effected with white light and the exposure steps 6 and 9 are confined to the picture areas. A similar product is obtained.

PROCEDURE IV.

The procedure I is followed except that step 8 is carried out immediately after step 6 and hence affects only layer (b). The operation of step 7 then re-exposes the sound track area of (f) and step 10 causes the formation of a positive magenta sound track in layer (f).

PROCEDURE V.

The procedure I is followed except that step 7 is effected before step 4, before step 6, before step 9 or before step 11, and is followed immediately by colour-development using any desired colour-former (i.e. not necessarily one used for any of the picture areas) yielding a positive sound track in coloured dye in layer (f).

PROCEDURE VI.

1. Expose to a coloured subject.
2. Expose sound area to record a negative sound track, the exposure being by white layer and therefore giving an image in all three emulsion layers.
3. Develop in a non-colour-forming developer.
4. Re-expose the picture area only of (f) with blue light.
5. Colour-develop layer (f) in a yellow colour developer.
6. Re-expose the picture area of (b) with blue light passing through (a).
7. Re-expose the sound track area only with white light.
8. Colour-develop (b) and the exposed sound track area with a cyan colour-developer.
9. Re-expose the picture area of (d) from both sides with white light of sufficient intensity to penetrate layers (c) and (e).
10. Colour-develop (d) with a magenta colour-developer.
11. Remove silver and residual silver salts by treatment with Farmer's reducer.

This procedure results in a product in which there is a true colour record of the original subject in the picture area and positive (i.e. reversed) sound track images in superposition in layers (b), (d) and (f), all in a cyan dyestuff.

PROCEDURE VII.

The procedure VI is followed except that the group of steps 6, 7 and 8 are carried out before the group of steps 4 and 5. A similar product is obtained.

PROCEDURE VIII.

The procedure VI is followed except that step 7 is effected before step 4, before step 6, before step 9 or before step 11, and is followed immediately by colour development using any desired colour-former, yielding superimposed positive sound tracks in layers (b), (d) and (f) in any desired coloured dye.

Various other combinations of the steps are permissible in accordance with the invention.

In some methods of processing to colour it is preferred to remove the first formed silver images before effecting the re-exposures. In the present invention such

removal may be carried out if desired.

The expressions "positive" and "negative" sound tracks used herein are to be understood as having the following meaning: The form of the sound track required in the final positive colour film for projection is considered to be a positive sound track, and a corresponding track in which the tone values are reversed is considered to be a negative sound track.

Dated this 29th day of November, 1946.

V. GALLAFENT,
Chartered Patent Agent.

COMPLETE SPECIFICATION

Improvements in or relating to the Recording of Sound Tracks in Colour Film

We, GEOFFREY BOND HARRISON, a British Subject, and ILFORD LIMITED, a British Company, both of 23, Roden Street, Ilford, in the County of Essex, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to colour photography and particularly to methods of colour photography using a multilayer photographic kine film wherein the processing of the layers of such film to form colour images therein involves the selective exposure of the layers, and is particularly concerned with the recording of a sound track in such film.

One technique which has been proposed for the production of a kine colour film employs a multilayer film which includes in superposition, in order, light-sensitive silver halide emulsions sensitive to blue, green and red light respectively and, separating the emulsion layers from one another, yellow filter or "barrier" layers. The normal photographic emulsion is sensitive to blue light and the yellow filter layer which lies between the blue-sensitive layer and the green-sensitive layer serves to absorb blue light so that when the film is exposed in the camera the blue light of the subject does not record in the red- and green-sensitive layers.

In processing such a material it is usual to form colour images in colours which are subtractive with reference to the utilised sensitivities of the layers. Thus a yellow positive image is formed in the original blue-sensitive layer, a magenta positive image in the original green-sensitive layer and a blue-green or "cyan" image in the original red-sensitive layer. The production of such colour positive images where the support for the emulsion is colourless and transparent or translucent may be as follows: After exposure in the camera the multilayer film is developed in a normal developer yielding negative silver images in the three emulsion layers. The blue-sensitive layer is then re-exposed to blue light and the effect of the exposing light is confined to the blue-sensitive layer by the yellow barrier layer lying behind it. This blue-sensitive layer is then processed to a positive yellow image. The red-sensitive layer is then exposed to blue light passing through the support and again the action of the blue light is confined to the red-sensitive layer by the adjacent yellow barrier layer. The red-sensitive layer is then processed to form a positive cyan image. In order to effect exposure of the middle layer which lies between the barrier layers, it has been proposed to use exposing light which is of such wavelength as will penetrate the barrier layers. Thus, if the green-sensitivity of this layer has not been destroyed by the earlier treatments, it is practicable to effect exposure by means of green light. Alternatively, the middle layer may be rendered developable by exposure to intense blue light, or by exposure to X-rays, or by chemical treatment, for example with a 5% aqueous solution of sodium arsenite or hydrogen peroxide or guanidine thiocyanate, and then developed to form a positive magenta image therein.

It is possible to record a sound track on the film using white light, in which case the sound track will appear in the final film as a reversed track recorded in each of the three layers as dye images of the same colours as the picture images in the respective layers. This method, however, is not wholly satisfactory and it is preferred that the sound track should be confined to a single layer, two layers, or all three layers of the material in a dye selected with regard to the characteristics of the photo-cell to be used in the reproduction, said dye not necessarily being one of the dyes used for a picture image.

In Specification No. 528,433 a process of producing a sound record in photo-

graphic film is described which consists in developing a silver salt sound image with a dye-forming developer which gives rise to a substantially neutral grey dye image which is opaque to the light used in the sound reproduction and this method may be employed to produce grey sound tracks in multilayer photographic film where the emulsion layers record three colour images in their picture areas.

The present invention is concerned with the use of a multilayer film comprising a support carrying three silver halide emulsion layers selectively sensitive to red, green and blue light (the red- and green-sensitive layers being in either order but both on one side of the blue-sensitive layer) and containing barrier layers (separating the emulsion layers) which have a substantial density to blue light. Such barrier layers may be present in the material initially or may be formed in the material during its processing provided, however, that a blue-absorbing layer is present in the original multilayer film between the emulsion intended to record the blue aspects of the subject photographed and the other emulsion layers.

In the present invention the picture record is obtained in such multilayer film by developing the exposed film in a reversal photographic developer, selectively rendering the residual silver halide in the emulsion layers developable, and developing such layers by means of an aromatic primary amino developing agent in the presence of colour-formers which couple with the oxidation products of such developing agent, formed during the development, to form quinone-imine or azomethine dye images respectively subtractive in colour in relation to the utilised sensitivities of the respective emulsion layers.

In the preferred form of the invention the colour-formers are included in the developing solutions, but the invention includes the possibility of one or more of the colour-formers being present in the emulsion layers (or in layers adjacent thereto).

The order of the emulsions in the multilayer material is preferably blue-sensitive, green-sensitive and red-sensitive, and the invention will be described with particular reference to a multilayer material of this kind. If the order of the green- and red-sensitive layers is reversed, adjustments in the order of the processing steps become necessary.

In accordance with the present invention, in employing a multilayer silver halide film material as above defined and processing it to form colour picture images therein by the method above defined, a negative sound track is recorded and developed in the material (by direct exposure or by printing) so that it is recorded and developed in one, two or all three of the emulsion layers, thereafter, as a step prior to, subsequent to, or intermediate between the steps of colour developing picture images in the material, the sound track area only of the film is re-exposed to form a reversed image in one, two or all three emulsion layers, and the reversed images thus obtained are colour-developed to form positive sound track images in coloured dyestuff, the dyestuff sound track images thus formed, or at least one of them, being in a colour different from the colour of the dyestuff used for the picture area of the layer in which the said track is located.

It is to be understood that in referring to the sound track images being in a "coloured" dyestuff, the use of dyestuffs which give neutral grey images is excluded from the invention.

Where any of the emulsion layers initially contains a colour-former the colour development will usually produce an image in the sound track in the dyestuff which is derived from the colour-former present in such layer, which will be the same dyestuff as is present in the associated picture area of that layer: in accordance with this invention, however, the colour development in such a case may be effected in the presence of a different colour-former present in the developing solution so that the resulting track is formed of two dyestuffs, one of which is of a different colour from that used in the picture area.

The first sound track may be recorded or printed in any one, any two or all three layers by suitable choice of recording or exposing light. The final positive sound track may be confined to any one, any two or all three of the layers by suitable choice of re-exposing light and within the limitation that the final record cannot exist in a layer in which the original sound track was not recorded. According to the stage of the processing at which the re-exposure or re-exposures of the sound track regions take place, the sound track or sound tracks may be produced by a single colour or a superposition of two or more colours. It is the feature of this invention that at least one of these colours is different from the colour in which the sound track image in that layer would have been reproduced had that sound track image been re-exposed and developed to colour simul-

taneously with the picture image in the same layer.

The following are examples of the various procedures which may be employed within the scope of the present invention. In these examples the multilayer material consists of:

(a) transparent or translucent colourless support.

(b) silver halide emulsion layer sensitive to red light.

(c) a layer absorbing blue light and either present in the initial material or formed therein during or immediately subsequent to the first development of the material.

(d) silver halide emulsion layer sensitive to green light.

(e) a layer similar to (c) which, if the blue-absorbing characteristic is formed during or immediately subsequent to the first development, also contains a blue-absorbing material which can be removed or destroyed at any convenient stage in the processing.

(f) silver halide emulsion layer sensitive to blue light.

For preference layers (c) and (e) are of the type described in Specification No. 595,582.

The assembly may contain other layers, e.g. an anti-halation layer and a non-stress supercoat layer if desired.

PROCEDURE I.

1. Expose to a coloured subject.
2. Expose sound area to record a negative sound track, the exposure being by blue light, thus confining the image to layer (f).
3. Develop in a non-colour-forming developer.
4. Re-expose the picture area only of (f) with blue light.
5. Colour-develop layer (f) in a yellow colour developer.
6. Re-expose picture area only of bottom layer (b) with blue light passing through (a).
7. Re-expose the sound track area only of (f) with blue light.
8. Colour-develop (b) and sound track of (f) in a cyan colour developer.
9. Re-expose picture area only of middle layer (d) from both sides with blue light of sufficient intensity to penetrate layers (c) and (e).
10. Colour-develop (d) with a magenta colour developer.
11. Remove silver and residual silver salts by treatment with Farmer's reducer.

This procedure results in a product in which there is a true colour record of the original subject in the picture area and a positive (i.e. reversed) sound track image in cyan dye in the original blue-sensitive layer.

PROCEDURE II.

The procedure I is followed except that the group of steps 6, 7 and 8 are carried out before the group of steps 4 and 5. A similar product is obtained.

PROCEDURE III.

The procedure I is followed except that the original exposure step 2 is effected with white light and the exposure steps 6 and 9 are confined to the picture areas. A similar product is obtained.

PROCEDURE IV.

The procedure I is followed except that step 8 is carried out immediately after step 6 and hence affects only layer (b). The operation of step 7 then re-exposes the sound track area of (f) and step 10 causes the formation of a positive magenta sound track in layer (f).

PROCEDURE V.

The procedure I is followed except that step 7 is effected before step 4, before step 6, before step 9 or before step 11, and is followed immediately by colour-development using any desired colour-former (i.e. not necessarily one used for any of the picture areas) yielding a positive sound track in coloured dye in layer (f).

PROCEDURE VI.

1. Expose to a coloured subject.
2. Expose sound area to record a negative sound track, the exposure being by white light and therefore giving an image in all three emulsion layers.
3. Develop in a non-colour-forming developer.
4. Re-expose the picture area only of (f) with blue light.
5. Colour-develop layer (f) in a yellow colour-developer.
6. Re-expose the picture area of (b) with blue light passing through (a).
7. Re-expose the sound track area only with white light.
8. Colour-develop (b) and the exposed sound track area with a cyan colour-developer.
9. Re-expose the picture area of (d) from both sides with white light of sufficient intensity to penetrate layers (c) and (e).
10. Colour-develop (d) with a magenta colour-developer.
11. Remove silver and residual silver salts by treatment with Farmer's reducer.

This procedure results in a product in which there is a true colour record of the original subject in the picture area and positive (i.e. reversed) sound track images in superposition in layers (b), (d) and (f), all in a cyan dyestuff.

PROCEDURE VII.

The procedure VI is followed except

that the group of steps 6, 7 and 8 are carried out before the group of steps 4 and 5. A similar product is obtained.

PROCEDURE VIII.

The procedure VI is followed except that step 7 is effected before step 4, before step 6, before step 9 or before step 11, and is followed immediately by colour development using any desired colour-former, yielding superimposed positive sound tracks in layers (b), (d) and (f) in any desired colour dye.

PROCEDURE IX.

The procedure VI is followed except that the re-exposure of step 6 is given to both picture and sound track area of (b) with blue light passing through (a). A similar product is obtained.

PROCEDURE X.

The procedure I is followed except that step 2 is carried out by giving an additional uniform exposure to red light so as to render that part of layer (b) in the sound track region developable, then step 6 may be simplified in that the re-exposure is given to the sound and picture areas instead of being restricted to the picture area.

PROCEDURE XI.

The procedure I is followed except that step 2 is carried out by giving additional uniform exposures to red and green (or yellow) light so as to render those parts of layers (b) and (d) in the sound track region developable, then steps 6 and 9 may be simplified in that the re-exposures are given to the sound and picture areas instead of being restricted to the picture area.

Various other combinations of the steps are permissible in accordance with the invention.

The invention will now be illustrated with reference to the following specific Example:—

EXAMPLE.

A photographic multilayer element was prepared consisting of the following layers in superposition in the order stated.

(a) Transparent colourless film support.

(b) Gelatino silver iodobromide emulsion, sensitised to the red region of the spectrum by means of 2.2¹.8-triethyl - 4.4¹ - dichloro-thiocarbocyanine bromide.

(c) Gelatin layer containing colloidal silver sulphide and silver halide (prepared as described below).

(d) Gelatino silver iodobromide emulsions, sensitised to the green region of the spectrum by means of 1.1¹ - diethyl - pseudocyanine iodide.

(e) Gelatin layer containing colloidal silver sulphide and silver halide (prepared as described below) and containing the dyestuff 1-*p*-sulphophenyl - 3 - methyl - 4 - cinnamylidene-pyrazole-5-one.

(f) Gelatino silver iodobromide emulsion having a natural sensitivity in the blue region of the spectrum and substantially insensitive to the green and red regions of the spectrum.

The layers (c) and (e) were prepared by adding to a 5% solution of gelatin, 5 cc. of M/100 silver nitrate solution and 2.5 cc. of M/100 thiourea solution per 100 cc. of gelatin solution, digesting at 120° F. for 60 minutes, and adding 10 cc. of fine grain silver iodobromide emulsion (containing 250 mgm. of silver) per 100 cc. of gelatin solution. In the case of layer (e) a quantity of the stated dye equal to 5% on the weight of the gelatin was added.

The element thus prepared was exposed to a coloured object and the sound area was exposed to record by blue light a negative sound record, the light being incident on layer (f). It was then developed for 8 minutes in a developer of the following formula:—

Metol	3 gms.
Sodium sulphite (anhydrous)	50 gms.
Hydroquinone	6 gms.
Sodium carbonate (anhydrous)	37.5 gms.
Sodium thiocyanate	2 gms.
Potassium bromide	2 gms.
Water to make	1 litre

This produced negative records in silver in layers (b), (d) and (f) corresponding to the red, green and blue aspects of the object and in addition, produced a yellow-brown silver deposit in layers (c) and (e) and bleached the dyestuff in (e). The element was then washed in running water for 20 minutes and then processed to give a full colour image in the following stages:—

1. Exposed the picture area only to the top layer (f) to blue light (not containing ultra-violet rays), the exposure being confined to this layer by the barrier layer (e) This exposure was made by means of a 125 watt high pressure mercury vapour lamp, the light from which passed through a blue filter substantially transmitting radiations only in the region 400—450 mμ of the spectrum (e.g. an Ilford filter No. 601). The word "Ilford" is a Registered Trade Mark. An exposure time of 10 seconds at one foot distance was found sufficient.

2. This layer (f) colour-developed in a yellow colour developer of the following composition:—

N.N-diethyl *p*-phenylene di-

amine hydrochloride - - 0.4 gm.
Ethyl alcohol - - - - 40 gms.
Sodium carbonate ($Na_2CO_3.10H_2O$)
20% solution - - - - 160 cc.
Sodium sulphite ($Na_2SO_3.7H_2O$)
20% solution - - - - 25 cc.
2:4-chloracetoacetanilide - 0.4 gm.
Potassium bromide - - - 0.1 gm.
Water to make - - - - 400 cc.

3. Washed for 10 minutes.

4. The picture area only in the bottom layer (b) and the sound track only of the top layer (f) were exposed to blue light (not containing ultra-violet rays), exposures being confined to these layers by means of the barrier layers (c) and (e) respectively. These exposures were made by the same light source and filter combination as used in stage 1.

5. Colour-developed in a blue-green colour developer of the following composition:—

N.N-diethyl *p*-phenylene diamine hydrochloride - - 0.4 gm.
Ethyl alcohol - - - - 40 cc.
Sodium carbonate ($Na_2CO_3.10H_2O$)
20% solution - - - - 160 cc.
Sodium sulphite ($Na_2SO_3.7H_2O$)
20% solution - - - - 25 cc.
2.4-dichlor-α-naphthol - - 0.4 gm.
Potassium bromide - - - 0.1 gm.
Water to make - - - - 400 cc.

6. Washed for 10 minutes.

7. The picture area only in the middle layer (d) exposed from both sides to ultra-violet rays which will penetrate the barrier layers. This exposure was made by means of a 125 watt high pressure mercury vapour lamp, the light from which passed through an ultra-violet transmitting filter which absorbed a high proportion of visible light, e.g. Wood's glass. An exposure time of 2 minutes at one foot distance was found sufficient.

8. This layer colour-developed in a magenta colour developer of the following composition:—

N.N-diethyl *p*-phenylene diamine hydrochloride - - 0.4 gm.
Ethyl alcohol - - - - 40 cc.
Sodium carbonate ($Na_2CO_3.10H_2O$)
20% solution - - - - 160 cc.
Sodium sulphite ($Na_2SO_3.7H_2O$)
20% solution - - - - 25 cc.
1 - *p* - nitrophenyl - 3 - methyl-5-pyrazolone - - - - 0.8 gm.
Water to make - - - - 400 cc.

9. Washed for 20 minutes.

10. Fixed and bleached in Farmer's reducer, removing all the silver and silver salts and (thus) the colour from layers (c) and (e).

11. Washed for 20 minutes.

The full colour image of the original object was thereby obtained as well as a positive (i.e. reversed) sound track image in cyan dye in the originally blue-sensitive layer.

The fine grain emulsion included in layers (c) and (e) was too slow to record an image during the various exposure operations.

The process described above and exemplified in the foregoing Example may be modified in various ways. For example, one or more of the exposed positive silver halide records may be processed to colour by methods other than colour development, e.g. by dye toning or chemical toning.

In some methods of processing to colour it is preferred to remove the first formed silver images before effecting the re-exposures. In the present invention such removal may be carried out if desired.

The expressions "positive" and "negative" sound tracks used herein are to be understood as having the following meaning: The form of the sound track required in the final positive colour film for projection is considered to be a positive sound track, and a corresponding track in which the tone values are reversed is considered to be a negative sound track.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for the production of colour film containing both colour records and sound track records which comprises employing a multilayer silver halide film material as hereinbefore defined and processing it to form colour picture images therein by the method hereinbefore defined, recording a negative sound track in the material by direct exposure or by printing so that it is recorded in one, two or all three of the emulsion layers, thereafter, as a step prior to, subsequent to, or intermediate between the steps of colour-developing picture images in the material re-exposing the sound track area of the film only to form a reversed image in one, two or all three emulsion layers, colour-developing the reversed images thus obtained to form positive sound track images in dyestuffs, and so selecting the colour-formers employed or the sequence of colour development steps that the dyestuff sound track images, or at least one of them, will be formed in a dyestuff of a colour different from the colour of the dyestuff used for the picture area of the layer in which the said track is located.

2. A process for the production of colour film containing both colour records

and sound track records which comprises employing a photographic element which consists of:

(a) transparent or translucent colourless support.

(b) silver halide emulsion layer sensitive to red light.

(c) a layer absorbing blue light and either present in the initial material or formed therein during or immediately subsequent to the first development of the material.

(d) silver halide emulsion layer sensitive to green light.

(e) a layer similar to (c) which, if the blue-absorbing characteristic is formed during or immediately subsequent to the first development, also contains a blue-absorbing material which can be removed or destroyed at any convenient stage in the processing.

(f) silver halide emulsion layer sensitive to blue light,

and exposing and processing said element in accordance with any one of Procedures I to XI hereinbefore set forth.

3. A process for the production of colour film containing both colour records and sound track records substantially as described in the specific Example hereinbefore set forth.

4. Photographic elements containing both a picture record and a sound track record whenever produced by the processes hereinbefore described and claimed.

Dated this 28th day of November, 1947.

V. GALLAFENT,
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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1949.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. 0d. each (inland) 2s. 1d. (abroad) may be obtained.